The Effects of Anthropogenic Food on the Body Condition, Biochemistry, Stable Isotopes and Egg Quality of Silver Gulls in Tasmania

Heidi J. Auman, BSc, MSc

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School of Zoology, University of Tasmania

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Declaration

This thesis contains no material which has been accepted for a degree or diploma by the University of Tasmania or any other institution, and to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due acknowledgement is made in the text of this thesis.

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Abstract

Many studies worldwide have attested to an increase in gull populations following urbanisation, and it is widely presumed that gulls have benefited as a direct consequence. However, foraging at tips and food outlets may induce a health cost in urbanised birds and the benefits of eating anthropogenic food should be questioned; the physiological health effects of 'garbivory' on wild birds are yet to be tested. This study was based on the premise that a negative effect on the health and hence fitness of gulls was expected from eating the equivalent of human 'junk food'.

This research investigated the potential adverse effects of an anthropogenic diet on the health of Silver Gulls (*Larus novaehollandiae*) by comparing birds breeding at a remote, non-urbanised site (Furneaux Island Group, Bass Strait) with those at an urbanised (Hobart) colony in Tasmania, Australia. A variety of approaches were used to assess the health of this species to gain a more comprehensive evaluation. Mass and body condition (measured by an index), stable isotopes in whole blood ($^{13}C/^{12}C$ and $^{15}N/^{14}N$), blood biochemistry (HDL- and total cholesterol, triglycerides, glucose, calcium, sodium, potassium and corticosterone), and egg quality (physical measurements and mass, absolute and proportional chemistries, shell thickness, yolk colour and historic comparisons) were compared between the two gull populations.

Urbanised gulls were heavier and had greater body condition than structurally identical non-urbanised gulls. Analyses of stable isotopes in whole blood suggested that remote, non-urbanised gulls tended to eat from a more marine origin, while urbanised gulls fed from a different food web and from a more freshwater/terrestrial origin. Assessment of

regurgitations suggested that although specific dietary items were generally either human-derived or natural, some overlap existed between sites. The urbanised gulls had higher levels of HDL-cholesterol in their blood. Clutch sizes did not differ, but eggs from the Furneaux Island Group were larger, heavier and had greater yolk mass than those from Hobart, as well as greater carotenoid concentrations in the yolk. Although urbanised Silver Gulls were apparently successful in laying eggs, poorer reproductive success may have resulted from smaller, lighter eggs that contain proportionally less yolk reserves. Overall, the Silver Gull provided a very good model to study the effects of urbanisation on a native species and numerous opportunities exist to focus future research in this area.

Acknowledgements

Most good students have a small army of silent supporters whose generosity and patience often goes unheralded. It's not possible to give each supporter detailed appreciation in a few pages, but I do hope that this method will convey my gratitude.

Dr Alastair Richardson, my Principal Supervisor, was my anchor. I could always count on him to keep me on track and focused on the big picture and his open door policy ensured that my questions were always answered immediately. Alastair also gave me numerous opportunities to demonstrate, treating me as a respected professional rather than a generic student to push through the system. Furthermore, I especially appreciated his great patience sorting through gull barf to identify arthropods.

Dr Catherine Meathrel, my Research Supervisor, was my inspiration. A fireball with the brainpower to back her up, Cath taught me all the tricks of the trade along with the myriad minutiae of Silver Gull lore. She welcomed me into the La Trobe University Marine Ornithology Group, her home and many professional opportunities to me as a friend. It was through Cath that I had access to vehicles, boats, equipment, bird bands and trusty technicians on Flinders and the surrounding islands in Bass Strait. Cath welcomed me into both Australian academia and Furneaux fieldwork full throttle and I hope that I lived up to her expectations.

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loaned me traps, donated medical supplies and drove me throughout southeast Tasmania for the annual winter and summer gull counts. Bill handed over stacks of his own valuable historic data on Silver Gulls in southeast Tasmania that dated back to 1983. More importantly, Bill and Els took me under their wings, mentoring, guiding, introducing me to instrumental people and offering their unqualified support and friendship. I am humbled by their generosity, and I hope that someday I can mentor others with the same complete support with which they offered me.

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Preface

This doctoral dissertation is composed of a general introduction (Chapter 1), general methodology (Chapter 2), and four experimental chapters (Chapters 3, 4, 5, 6). Three of these have been submitted as manuscripts to peer-reviewed journals and one was written as a chapter. The general discussion (Chapter 7) includes a summary of all results, comparisons to other synanthropic larids, population trends and management implications. Finally, a list of presentations arising from this research is given is Appendix I and a list of media coverage is given in Appendix II. The author, Heidi J Auman, has written all of these chapters and performed all statistical analyses. Supervisors Alastair Richardson and Catherine Meathrel have provided advice and editing throughout, and are therefore listed as co-authors in the chapters written as manuscripts for publication.

The experimental chapters submitted to/accepted in journals have been reformatted to fit the guidelines for this dissertation, but the complete title pages, keywords and acknowledgements were not included. Australian English and spelling remain in the chapters submitted as manuscripts to American journals. All figures and tables for each chapter were placed before the bibliographies to retain the flow of text. Some overlap of material appears, especially in the introductions, as each data chapter was written as a stand-alone paper. The four experimental chapters are:

CHAPTER 3. Urbanisation of Silver Gulls: evidence of anthropogenic diet from stable isotope analyses. Heidi J Auman, Catherine E Meathrel and Alastair Richardson. 2007. Submitted to Condor.

CHAPTER 4. Supersize me: does anthropogenic food change the body condition of Silver Gulls? A comparison between urbanised and remote, non-urbanised areas. Heidi J Auman, Catherine E Meathrel and Alastair Richardson. 2007. Accepted in Waterbirds.

CHAPTER 5. Blood biochemistry of Silver Gulls in urbanised and remote colonies of Tasmania. Heidi J Auman, Catherine E Meathrel and Alastair Richardson. 2007. Accepted in Emu (Austral Ornithology).

CHAPTER 6. Comparison of egg quality in Silver Gulls feeding from anthropogenic versus natural food sources. (to be submitted at a later date as at least two manuscripts)

TABLE OF CONTENTS

List of Tables

List of Figures

We have not succeeded in answering all of your problems. The answers we have found only serve to raise a whole set of new questions. In some ways we feel we are as confused as ever, but we believe we are confused on a higher level and about more important things.

~Anonymous